



## **GLOBAL FOOD TRENDS TO 2030**

WITH A CLOSER LOOK AT THE GCC

## **Table of contents**

About this research	3
Executive summary	4
Chapter 1: Socio-economic trends that impact food systems	6
Chapter 2: Scientific and technological trends that impact food production and distribution	12
Chapter 3: A closer look at the GCC	20
Conclusion	26

## **About this research**

Global food trends to 2030: With a closer look at the GCC is a Dubai Industrial City report written by The Economist Intelligence Unit (EIU). In this paper, The EIU presents key trends that are shaping the global food industry landscape, focusing on food production and the supply chain, followed by a closer look at those relevant to the Gulf Co-operation Council (GCC) countries.

We have identified these trends through an extensive literature review combined with in-depth interviews with food experts, comprising academics and executives at food companies from around the world—and specifically the GCC. A framework was developed to identify high-priority trends, based on the following considerations:

**Response:** Is the trend a response to challenges (e.g. food security, ecological damage health and nutrition) or opportunities (e.g.emerging technologies)?

**Breadth**: Does the trend affect multiple food types or a broad share of the food that we consume?

**Novelty**: Is the trend relatively new, fast-evolving and/or characterised by relatively low awareness?

**Applicability:** Is the trend potentially global in its application?

The EIU wishes to thank the following experts (listed alphabetically) who participated in the interview programme for this report:

## **Global perspective**

- **Ted Bilyea**, advisor to the board (and former chair), Canadian Agri-Food Policy Institute
- David Croft, director, global sustainability, Diageo
- Evan Fraser, director, Arrell Food Institute, University of Guelph, Canada

- Lawrence Goodridge, associate professor, Food Safety and Quality Program, McGill University, Canada
- Dato' Joel Low, chief executive officer, Agrivo International
- Santanu Mukherjee, head of digital marketing, Indusnet
- Danielle Nierenberg, president and founder, Food Tank, USA
- Tamika Sims, director, food technologies communications, International Food Information Council Foundation
- Maximo Torero, executive director (Argentina, Bolivia, Chile, Paraguay, Peru, Uruguay), World Bank
- Prem Warrior, chief operating officer, Centre for Agriculture & Biosciences International, Valagro

## **GCC** perspective

- Joanne Cook, managing director, Sial Middle East
- Eihab Fathelrahman, assistant professor, agribusiness & consumer science, College of Food and Agriculture, United Arab Emirates University
- Tara Fischbach, research assistant,
  Mohammed Bin Rashid School of Government
- Gigi George, managing director, Euro Choice Foods Oman
- **Shabbir Ahmad Shahid**, former senior fellow, International Centre for Biosaline Agriculture

David McInnes was the author of this report and Melanie Noronha was the editor. Conor Griffin, Sabika Zehra and Garima Das from EIU Consulting led the literature review.

## **Executive summary**

Any discussion about the global food system should be understood in the context of three overarching perspectives. First, modern agriculture and global trade have, for many, delivered unprecedented access to an abundance of safe. affordable and diverse foods. The history of agriculture has demonstrated that the food system is capable of adapting to change, usually with the aid of technology, policies and practices designed to enhance food safety and encourage trade. Second, despite this optimistic view, food insecurity remains an issue for vulnerable populations across the world, from advanced economies to impoverished ones—and this is seen by many as a matter of human rights and equity. Third, there is a rapidly emerging view

that the planet's food system is simply unsustainable, both environmentally and in terms of health and diet.

These perspectives form a backdrop against which global food trends should be considered. This report identifies 20 such trends, following conversations with global and GCC-based agri-food leaders. The trends are grouped into two categories: chapter 1 reflects on eight systemic economic, environmental and social trends that cut across food production and the supply chain; chapter 2 addresses the breadth and potential of technology change against a backdrop of the fourth industrial revolution in 12 trends, which promise to foster more successful, responsible and resilient food systems.

### Socio-economic



## **MACRO**

- A shift in mindset towards the circular economy and systems thinking
- Greater attention to national food security strategies
- The threat of trade wars



## SOCIAL

- Growing demand for equity and rights
- Encouraging youth and women into farming



## CORPORATE

- Increasing adoption of national and corporate sustainability targets
- The development of true cost accounting and sustainable capital
- Increasing corporate concentration in the food sector

## Scientific and technological



## **PRODUCTION**

- The rise of technology-enabled food production
- The emergence of controlled systems for facilitating local food production



## **DISTRIBUTION**

- Supply chain transparency enabled by IoT, blockchain, smart and clean labels
- Supply chain productivity enabled by IoT and blockchain
- The debate over data ownership in the food industry
- Evolution of the last mile (retail)
- Evolution of the last mile (restaurants)
- Programmes and apps to redistribute surplus food



## AGRICULTURAL SCIENCE

- The race to create climate-resilient crops
- Harnessing carbon through regenerative agriculture
- Growing resistance against use of antimicrobials in foodproducing animals
- The quest for alternative sources of protein

Three of these trends have particular relevance for GCC food producers and policymakers:

- The emergence of controlled systems for facilitating local food production. As a region that faces key agricultural constraints (such as those related to water and soil), new technology emerging through 'Industry 4.0' can create and scale-up domestic food production opportunities, for example by expanding non-traditional agricultural production (such as hydroponics).
- A shift in mindset towards the circular economy. Pursuing more sustainable practices, such as improving food waste management and considering food production and supply with a life-cycle in mind, can deliver economic efficiencies and unleash innovation across the food system. This in turn can improve the industry's

environmental footprint, food supply and a host of related social issues, such as poor nutrition.

• Greater attention to national food security strategies. By leveraging its role as a regional trade hub, the GCC can position itself as a leader in fostering trade in sustainably-sourced food, with its associated economic benefits, and further help to reduce food supply risks at a time of increasing global trade uncertainty.

These priority trends, and other ideas presented in this report, offer the GCC a means to focus its internal dialogues on ways to improve its food system and food security resilience. Taking such an integrated approach may also inspire others outside the region to respond to profound changes taking place across the food system, thereby enhancing the GCC's global leadership role.

**Chapter 01** 

# Socio-economic trends that impact food systems

Food producers, processors and retailers, among others involved in vast agri-food supply chains, are responding to fundamental questions about food from consumers, investors and society at large. With increasing climate stress and other social and health issues facing national populations, people are increasingly concerned with where their food comes from, how it is produced, and what impact is has on the planet and their health. These growing concerns are catalysing market-wide change and prompting new business models to be embraced. Meanwhile, the economic circumstances in which the food industry finds itself are also evolving, as ever. This chapter describes eight major trends that are shaping the socio-economic environment in which food production and distribution take place.

## 1. A shift in mindset towards the circular economy and systems thinking

A circular economy minimises negative environmental impacts, creates new value from waste streams, and manufactures products and packaging with a view to how they will be used, repurposed or recycled. This is changing the way that stakeholders in the food industry think about the "food system", which includes traditional players such as producers, processors, distributors, wholesalers and retailers, as well as a far broader set of adjacent players.

Soybeans, for instance, are produced for food and animal feed, as well as for biofuels and for making consumer goods such as car parts. And preventing food contamination is not just about improving food safety across a supply chain. Harmful e-coli contamination can sometimes be linked to unclean water in a local field in a developing country or poor hygiene of farm workers. Resolving the problem involves bigger societal and ecological issues.

For corporations, there are opportunities for new revenue streams and business growth. Danone uses whey protein, an effluent ("waste") product of Greek yogurt making, to create new products and revenues, such as in its baby nutrition business. The company is shifting how it thinks about resource use across its supply chains in terms of cycles and not in the conventional linear way.

When considering national food strategy or corporate strategy, therefore, a broad array of potential stakeholders – beyond the traditional supply chain – should play a role in the dialogue.

## 2. Greater attention to national food security strategies

Government-led food security strategies are defining food production and supply chain trends. The size of strategic reserves determines local food production levels, and land acquisition strategies determine the composition of food produced locally and food imported.

Strategic food reserves are a core component of a country's food security plan, particularly for import-reliant countries. The key challenge is deciding how large such reserves should be. China's corn reserves, for example, are rumoured to cover more than seven months of consumption, even though most experts believe that three months is sufficient.

Larger reserves carry costs in areas such as logistics, product loss and cost of capital. To minimise costs, one option is to develop regional reserves with neighbouring countries. Governments can also encourage the private sector to set up food storage and distribution facilities and establish themselves as regional hubs for food processing and trade.

Data suggest an increase in agricultural land acquisitions abroad in recent years.<sup>2</sup> Investors are typically from the Global North and emerging economies of Asia and Middle East with relatively less cultivable land. China is becoming the largest investor in Australian farmland and Saudi Arabia is investing in Africa and elsewhere. The target countries are typically located in the Global South and Eastern Europe, which are well endowed with cultivable land, but with fewer funds to invest in highly productive farming. About 25% of global cropland area, and its associated use of water and other inputs, now produces commodities that are exported to land-poor but cash-rich countries.<sup>3</sup>

A circular economy minimises negative environmental impacts, creates new value from waste streams, and manufactures products and packaging with a view to how they will be used, repurposed or recycled

Jann Lay and Kerstin Nolte, "Determinants of foreign land acquisitions in low- and middle-income countries". Journal of Economic Geography 18 (2018) pp. 59–86, Advance Access Published on 3 June 2017. doi:10.1093/ iea/lbx011

<sup>3</sup> UN Convention to Combat Desertification (UNCCD) at the launch of the Global Land Outlook



## 3. The threat of trade wars

With increasing trade threats, alliances and regional-based trade agreements are gaining in importance. Tariff wars will be disruptive for a trade-dependent food sector. Trade tensions are rising between the US and China, and Canada and the EU, and tit-for-tat tariffs have already altered the global agricultural marketplace. China has turned to Brazil for soybean imports and Australia for beef and cotton, all previously sourced from the US.<sup>4</sup>

Research by the International Food Policy Research Institute demonstrates that the impact of tariff wars on welfare is zero or negative to all feuding parties<sup>5</sup> and will erode benefits of global trade in terms of food access and nutrition. It is an opportune time for regional food hubs to rethink their strategies with regards to serving the regional and global food system.

Research by the International Food Policy Research Institute demonstrates that the impact of tariff wars on welfare is zero or negative to all feuding parties and will erode benefits of global trade in terms of food access and nutrition

## 4. Increasing adoption of national and corporate sustainability targets

Worldwide, bold performance targets are being set by companies, governments and non-governmental organisations (NGOs) to create positive change towards sustainability, among other objectives. Countries and food companies will be expected to account for their actions, shaping the way that food is produced and distributed. The agricultural sector plays an important role in relation to sustainability, given that it is the second-largest contributor to global greenhouse gas emissions (24% of the total).<sup>6</sup>

In food production this translates not only to greater use of renewable energy on farms and processing facilities but also includes soil health management. Leaders in "corporate climate action", as measured by CDP (previously Carbon Disclosure Project, a non-profit emissions disclosure programme), are going further, driving sustainability along the supply chain.

But to meet their bold targets, food companies must engage their supply chains. General Mills, a US food manufacturer, has committed to reducing greenhouse gas emissions across its value chain by 28% by 2025 (compared with 2010 data). The company has partnered with suppliers of key ingredients to help them measure environmental impact and grow sustainably.<sup>7</sup>

Some companies are using these targets to create new products, increase brand value and thus drive business growth. Tetra Pak, in response to demand from its clients, has developed a sustainable packaging product line. In addition to providing an exciting new product offering, it enables the firm's clients to meet their sustainability targets.

Non-government organisations publish scorecards on a variety of food company practices from animal welfare to unsafe labour practices. The Global Access to Nutrition Index annually ranks the world's largest food and beverage companies on how their practices and food formulations improve healthy eating and nutrition. It urges companies to link CEO remuneration directly to nutrition performance to ensure that progress is being made.

By influencing production, supply chain and even internal corporate behaviour, target-setting has the potential to create system-wide change.

## 5. The development of true cost accounting and sustainable capital

Failure to measure and disclose environmental impact and climate risk, and other food impacts, has made it challenging, if not impossible, for the food system to price in externalities such as external health or environmental impacts. The UN Environment Program is developing a framework to determine how true cost accounting can work, including how to better assess valuing natural capital (water and biodiversity) in food production.

G20 finance ministers and central bankers have been driving the development of a framework for climate-related financial disclosures, to enable better risk management by companies themselves and provide better information for investors.8 Financial institutions, including banks, insurers and asset managers, are doing more to assess environmental risk across their vast portfolios. For example, some national pension funds are making explicit commitments to restricting investment in the oil and gas sector (such as in Norway<sup>9</sup>) in order to facilitate the shift toward a low-carbon economy. Furthermore, global financial players are beginning to assess risk and investments against a broader set of environmental, social and governance (ESG) investment principles.

This has ramifications for supply chains. In the food industry, interest in "impact investing" will trickle down to distributors, processors and farmers, encouraging them to measure and act on climate-related business information. In one pilot study, the Banking Environmental Initiative is exploring how to incentivise sustainable production and exports by assessing the feasibility of "sustainable shipment letters of credit". With over 80% of global trade reliant on trade finance, this could have a broad impact.<sup>10</sup>

- 4 https://www.ft.com/content/90721170-7b89-11e8-8e67-1e1a0846c475
- http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/131368
- 6 http://www.fao.org/3/a-i6340e.pdf
- https://globalresponsibility.generalmills.com/HTML1/general\_mills-global\_ responsibility\_2018\_0031.htm
- 8 Task Force on Climate-related Financial Disclosures, G20 Finance Ministers & Central Bank Governors, 2017
- https://www.nbim.no/en/transparency/news-list/2017/norges-bankrecommends-the-removal-of-oil-stocks-from-the-benchmark-index-of-thegovernment-pension-fund-global-gpfg/
- "Trade finance", World Trade Organization: https://www.wto.org/english/ thewto\_e/coher\_e/tr\_finance\_e.htm

Sustainable capital initiatives are on the path to becoming mainstream and will increase corporate screening of ESG performance of both companies and their suppliers. Quantifying externalities will continue to remain challenging, but embracing the idea would be transformative.

## 6. Growing demand for equity and rights

Global supply chains are increasingly expected to respond to the rights and needs of people in local communities. Moody's, the ratings agency, now assesses global mining companies that operate in countries where using local water can create social conflict and risk the investment. This is a cautionary tale for the food sector, as it could invite similar attention, encompassing food production and the supply chain. Some firms have been proactive on this front. Cargill, a multinational food production and distribution company, aspires to have zero incidents of child labour in its supply chains by 2025.

Gender equality is also attracting interest. The overall premise of the UN Sustainable Development Goals (SDG) is "leave no one behind", and eradicating poverty and hunger (goals 1 and 2 of the SDGs) is tied to making progress on educating girls and involving women in community decision-making. Women are key to small-scale agriculture, particularly in low-income countries, and contribute to food security and social stability in their communities.

More broadly, NGOs are advocating for the right to food. Pressure is building on governments and agri-food companies to respond to the food needs of vulnerable populations and ensure population health as a whole.

## 7. Encouraging youth and women into farming

Across the world, traditional communities of farmers and fishers are becoming older and the agricultural and fishery industries are failing to attract young people or women in sufficient numbers. Women comprise 43% of the agricultural labour force in developing countries and just 13% of agricultural land holders.<sup>11</sup>,<sup>12</sup> In some instances, particularly among the young, falling incomes, rising debt and rural poverty, are forcing people to leave conventional farming.

In response, governments are initiating policies to encourage young people and women to become farmers. Examples include financial support, funding education programmes and insurance programmes to protect against future losses. In New South Wales in Australia, the Young Farmer Business Program is a four-year initiative to provide young farmers and fishers with access to new business ideas, tools, products and services, as well as connecting them with each other. The UK's Young People Into Agriculture Scheme and Canada's Agricultural Youth Green Jobs Initiative have similar objectives.

## 8. Increasing corporate concentration in the food sector

In the early 2000s two companies controlled nearly half of the global banana trade. More recently, seed, fertiliser and chemical companies have been merging. Concentration of the grocery sector is also an issue in several countries, including the UK, although new competition from discounters and online companies could change this situation (online retail could become particularly disruptive).<sup>13</sup>

There are many sound economic reasons for this trend. The food system needs capital and research and development (R&D) capacity to innovate, and innovation is critical to help global agriculture adapt to changing agronomic and market conditions. But the question of who owns the intellectual property flowing from this work is a growing concern, as is the need to prioritise consumer health and safety above profit.

## Women comprise:

43% of the global agricultural labour force

13% of agricultural land holders in developing countries

 $<sup>^{13} \</sup>quad \text{http://www.economicsonline.co.uk/Business\_economics/Supermarkets.html}$ 



Thtp://www.fao.org/fileadmin/templates/nr/sustainability\_pathways/docs/ Factsheet\_SMALLHOLDERS.pdf

http://www.unwomen.org/-/media/headquarters/attachments/sections/library/publications/2018/sdg-report-fact-sheet-global-en.pdf2l-anglyer\_5E54

**Chapter 02** 

# Scientific and technological trends that impact food production and distribution

Farmers and food companies alike have always sought better ways to produce and supply food. Trends 9 to 20 reveal that the speed and extent of adopting new technology emerging as a result of the fourth industrial revolution (exploiting automation and data generated from the Internet of Things) and applying the latest scientific thinking will become the hallmark of more successful and resilient food systems going forward. Researchers, scientists, entrepreneurs and technology providers will play an increasing role in this emerging agri-food economy.

## 9. The rise of technology-enabled food production

The deployment of artificial intelligence (AI), robotics and data management, among a range of other technologies, is often heralded as one of the biggest trends to impact food production.

Such technologies promise to take precision agriculture to a new level. Advanced analytics and supportive technologies will enable better management of plant and animal health, and even inform farmers of the optimum time to harvest. They can help plant growers to manage water and nutrient needs, soil health, weeds, and stress from insects and disease. Research from Cornell University has demonstrated how an Al algorithm can detect brown leaf spot disease on cassava leaves with 98% accuracy.<sup>14</sup>

Used in animal agriculture, wearable sensors can gauge animal health every second, improving care and feed efficiency. Cognitive technologies will bring data together from many sources (such as weather data, drone data, market trends and images) to inform farm-level and food company decision-making on an unprecedented level.

Self-driving tractors and other robots are increasingly being deployed to cut labour costs and reduce food production time. Today, agricultural robots (agrobots) are picking lettuce and strawberries, mowing hay, harvesting oranges and pruning grapevines, guided by precise GPS tracking and Al-based instructions. Aerial drones are becoming increasingly efficient at surveying fields (even at small-scale farms) to identify weather-related damage, and pest and disease infestation. IDTechEx, a business intelligence firm, estimates that the global industry encompassing technologies such as agrobots and agricultural drones will be worth US\$35bn by 2038.<sup>15</sup>

These technologies will become more widely available even among some of the poorest and smallest-scale farmers. In Mantaro, Peru, small-scale farmers already use community mapping from the Geophysical Institute of Peru in Lima to show local climate changes and hotspots.<sup>16</sup>

Estimates suggest that, by 2020, more than 75m connected agricultural devices will be in use globally, while a regular farm in the US alone is expected to generate an average of 4.1m data points every day in 2050<sup>17</sup>. The speed of technology development,

breadth of applications and its transformative power of being scale neutral are particularly significant.

## 10. The race to create climate-resilient crops

The International Centre for Tropical Agriculture (CIAT) projects that crop yields will fall by more than 10% for a quarter of major crops by 2030 and decline at similar rates for more than half of crops beyond 2050 as a result of climate change.<sup>18</sup> In addition, researchers are asking questions about how climate change may be making food less nutritious. Studies show that rising CO² levels are reducing key nutrients such as iron, zinc and protein in rice and wheat crops.<sup>19</sup>

In response, researchers are aiming to create climate-resilient crops through selective breeding and genetic modification, and are setting up international seed banks to share innovative seeds. The CIAT has developed drought-tolerant rice and beans, insect and disease-resistant cassava, and superior tropical forages that are adapted to flooding and other harsh weather conditions. The Philippines-based International Rice Research Institute is producing strains of rice that consume less water and provide more nutrients. The institute has created more than 800 varieties of rice deployed in nearly 80 countries. Emerging technologies, such as CRISPR, a gene editing tool, could usher in new plant breeds to cope with climate stress, but such new technologies can also result in greater opacity and consumer mistrust.

There are other consequences of climate change that cannot be ignored. Crop failures (brought on by drought or other calamities) seem to encourage a certain amount of food fraud. Following a crop failure in China, a large amount of garlic powder was adulterated through the addition of chalk or talcum before it entered the marketplace.<sup>20</sup>

- <sup>14</sup> https://arxiv.org/abs/1707.03717
- https://www.idtechex.com/research/reports/agricultural-robots-and-drones-2018-2038-technologies-markets-and-players-000578.asp
- <sup>16</sup> IDRC in Nature 559,23-26 (2018).
- http://uk.businessinsider.com/internet-of-things-smart-agriculture-2016-10
- 18 http://ciat.cgiar.org/what-we-do/climate-smart-agriculture/
- https://www.sciencedaily.com/releases/2018/08/180827180806.htm
- 20 "Is there chalk and talcum in your garlic powder? Food fraud expert warns of tainted garlic product", National Post, April 18, 2017.

## 11. The emergence of controlled systems for facilitating local food production

Controlled systems are growing in popularity, as they offer the potential for higher yields with less labour, less land use, fewer chemicals and a fraction of water waste. These include hydroponics, aquaponics and aquaculture farming, among others.

Hydroponics is a technique for growing agricultural products in a water-based nutrient solution instead of soil. There is evidence that average yields are considerably higher using hydroponics than conventional, soil-based agricultural techniques—in the US, 8.71 lbs/sq ft of lettuce were grown using greenhouse hydroponics, compared with 0.69 lbs/sq ft using conventional techniques.<sup>21</sup>

Hydroponics is also expected to generate substantial water savings (estimated at above 90%) but can be costly to construct and maintain (given controlled temperature and lighting requirements). Profitability comparisons are harder to make as the payback period is longer for hydroponics than soil-based systems (between five and seven years) and many hydroponics farms have been operational for only a few years.<sup>22</sup>

Aquaponics is the integration of aquaculture and hydroponics. Both can work well in areas where soil

quality is poor and water is scarce. Examples include urban areas, arid climates and low-lying islands.

One of the largest aquaponics centres in the world, Baniyas Centre, is in Abu Dhabi. Other prominent examples can be found in urban centres in the US and several arid regions in African countries (prominently in South Africa, Namibia and Botswana). Estimates put the market for aquaponics at more than US\$500m in 2017 and project it will exceed US\$1.2bn by 2023.<sup>23</sup> Growing Underground, a London-based company, uses hydroponics to grow plants underground, and industrial-scale adoption of hydroponics is emerging in several countries including the US, Australia and Indonesia.

The vertical farm concept aims to significantly increase productivity and reduce the environmental footprint of farming within urban, indoor, climate-controlled high-rise buildings. New York is a leader in urban agriculture (mainly rooftop farming). The Bowery warehouse farm and AeroFarms in nearby New Jersey are two of the largest high-tech organic indoor farms in the world. Their growing popularity will upset the traditional view that agriculture is a rural industry.

These controlled systems are important for several reasons. If food is grown locally, it can shorten the food supply chain, reduce its carbon footprint, stimulate local economies and provide jobs.

## Yield by agricultural production type for leafy green vegetables

Yield (lb/sq ft)

CONVENTIONAL AGRICULTURE



0.69

CONTAINER FARM HYDROPONIC



3.75

VERTICAL HYDROPONIC



5.45

GREENHOUSE HYDROPONIC



8.71

Source: State of Indoor Farming 2017, Agrilyst

## 12. Harnessing carbon through regenerative agriculture

Carbon is essential to agriculture. Proponents of regenerative agriculture shun industrial chemicals and fertilisers, and practices such as monoculture (the cultivation of a single crop in a single area) and genetically modified organisms (GMOs). Rather, they aim to minimise tillage, better manage grazing practices and improve soil health using cover crops, crop rotation, compost and animal manure.<sup>24</sup> By increasing soil organic matter, the soil biota (organisms in a particular region) become more diverse. Deeper plant root systems help to fix carbon and retain water.

Not all farmers agree with foregoing chemicals and other inputs, but farmers worldwide are turning their attention to improving soil health. By adding pea flour to wheat, the Canadian pulse industry has shown that it can significantly increase fibre and protein (which is good for those seeking to improve nutrition) and lower the carbon footprint of a piece of bread by 23%. Pulses such as peas and lentils fix nitrogen in the soil, naturally sequestering carbon.

Interest in ecological goods and services (EGS) is rising among traditional farmers. Farmers produce food that generates income for them and can help to protect biodiversity, reduce greenhouse gases, sequester more carbon and improve water systems, all public goods. Best management practices guide farmers to do both. How to get society (or governments) to pay for these beneficial environmental services, which cannot be captured in the price of food, is the stumbling block to fuller implementation of EGS.<sup>25</sup> But acknowledging that agriculture could be the lynchpin to transition to a low-carbon economy by sequestering even more carbon can help to drive this forward.

## 13. Growing resistance to use of antimicrobials in food-producing animals

Anti-microbial resistance (AMR) threatens global public health, prompting greater scrutiny of food system practices. According to the World Health Organisation (WHO), resistance to drugs is complicating the fight against HIV, malaria and tuberculosis, among others. Misapplication of antibiotics in livestock and aquaculture is one issue, prompting the call for better stewardship. In the US,

## A growing base of conscious consumers is expected to increase demand for antibiotic-free meat

60% of all medically important antibiotics administered in 2016 were used in food-producing animals.<sup>26</sup> The figure is as high as 80% in some countries.<sup>27</sup>

To combat this, the WHO has developed guidelines on the use of medically important antimicrobials in food-producing animals. This was informed, in part, by the success of Namibia's ban (introduced in 1991) on the use of hormones and antibiotics for growth promotion and disease prevention in the beef industry.<sup>28</sup> The ban has benefitted the country's beef exports, allowing exporters to command a premium price and access new markets. A growing base of conscious consumers is expected to increase demand for antibiotic-free meat.

## 14. The quest for alternative sources of protein

The supply of alternative sources of protein is expected to rise sharply by 2050 in response to growing global protein demand, increasing concerns over the environmental effects of livestock farming, the rise of "clean eating" and concerns for animal welfare. For example, synthetic meat, also known as cultured or "clean" meat, is grown through stem cell cultures and (in some cases) 3D printing. Edible insects are also being considered as a type

- <sup>21</sup> State of Indoor Farming 2017, Agrilyst
- $^{\rm 22}$   $\,$  State of Indoor Farming 2017, Agrilyst
- $^{23} \quad \text{https://www.futuremarketinsights.com/reports/aquaponics-market}$
- <sup>24</sup> "What is Regenerative Agriculture?", Regeneration International, February 16, 2017.
- 25 "Environmental and Ecological Goods and Services, Overview", Ontario Federation of Agriculture, https://ofa.on.ca/issues/environmental-ecological-goods-services/
- https://www.fda.gov/downloads/forindustry/userfees/ animaldruguserfeeactadufa/ucm588085.pdf
- 27 http://www.who.int/news-room/detail/07-11-2017-stop-using-antibiotics-in-healthy-animals-to-prevent-the-spread-of-antibiotic-resistance
- 28 http://www.who.int/news-room/feature-stories/detail/namibia-s-ban-on-antibiotics-in-healthy-animals-drives-meat-exports

of protein-rich food product that doesn't require soy or GMOs. US-based start-up Aspire is farming food-grade crickets and palm weevil larvae on a commercial scale in the US and Ghana.

The food and technology industries are working together to create new plant-based substitutes to cheese, meat and eggs. In Silicon Valley, investment in food tech companies or projects increased at an average rate of 37% from 2012 to 2015. Tyson Foods, a US meat producer, invested in Beyond Meat, and Nestlé purchased Sweet Earth Foods, which sells "harmless ham", a vegan meat substitute.

## 15. Supply chain transparency enabled by IoT, blockchain, smart and clean labels

Consumers are demanding greater transparency over where their food comes from. In response, food producers, processors and distributors are transforming product labelling with microscopic electronic devices, genetic markers for agricultural products and a new generation of barcodes. Barilla, an Italian food company, uses smart labels to give consumers full visibility into its supply chain. Using a mobile phone to scan the package's QR code, consumers can learn where, when and how each ingredient made its way into that particular package, from the farm to the plant to the store shelf.

In addition, food labels are regularly criticised by campaigners for their complexity and inaccuracy. For instance, "calorie per serving" measures are often based on inaccurate serving sizes, misleading consumers about how many calories they are consuming. As part of improving transparency, consumers are demanding cleaner labels. In the US, a new food-labelling system will soon make "calorie per serving" notices more accurate and the amount of sugar more prominent. The EU has passed new food-labelling requirements that, among other things, will make labels more legible. Many people want simple "traffic-light" labelling schemes that allow for quick judgements about how healthy, or suitable, an item of food is.

Eco-labels have proliferated too. As the pressure increases to produce, process and serve up better-for-you and better-for-planet offerings, there is a risk of "green-washing", where a company

Consumers are demanding greater transparency over where their food comes from. In response, food producers, processors and distributors are transforming product labelling with microscopic electronic devices, genetic markers for agricultural products and a new generation of barcodes

deceptively promotes itself or its products as environmentally friendly. Now, with expectations rising about implementing the UN SDGs, "greenwashing" may be replaced with "SDG-washing".

Blockchain, a digital ledger, has the potential to help fight food fraud and enable rapid and targeted food safety recalls. Combined with the Internet of Things (IoT), distributed ledgers could help all supply chain stakeholders to access information such as product origin, certifications, shelf-life and cargo temperature, among others, at the click of a button. As well as transmitting data and issuing alerts, when equipped with radio frequency identification (RFID) sensors, objects become uniquely identifiable.

Blockchain is promising but still depends on the accuracy and quality of inputted data and the cooperation of participating network of stakeholders. If successfully implemented, however, blockchain could build greater transparency, improve food safety and traceability of sustainability measures across food supply chains.

## 16. Supply chain productivity enabled by IoT and blockchain

The emerging technologies discussed in relation to the preceding trend also have the potential to streamline processes involved in food trade, reducing the time to complete some tasks from weeks and days to minutes or even seconds. In a highly publicised event, IBM recently demonstrated the ability to trace the provenance of mangoes within a global supply chain within a matter of hours.

Meanwhile, fully automated robots are increasingly able to handle tasks such as stacking, sorting and transporting goods, while Al-powered scanners and sensors can track products in each step of the process. Globally, forecasts suggest that warehousing robot shipments will increase from 40,000 in 2016 to 620,000 units by 2021.<sup>29</sup>

Productivity gains can be achieved across the supply chain, all the way to consumers and homes, using IoT. Smarter, a UK-based technology firm, is using cameras coupled with AI software in refrigerators to assess stocks. Smarter has partnered with supermarket chain Tesco to share and analyse this data, enabling improved

inventory management.

Advanced analysis of data collected through connected devices can lead to better planning, reduced waste and revenue growth. Silicon Valley-based Zest Labs is trying to prevent food loss by monitoring perishable foods with real-time analytics. The firm Purfresh is using the IoT to enhance transport of perishable food items. It collects real-time data on the atmospheric conditions inside refrigerated containers and sends automatic alerts in case the temperature is out of the required range, allowing remote logistics managers to take mitigating actions.

## 17. The debate over data ownership in the food industry

Consumers and companies readily trade a certain amount of privacy for being able to access a benefit or service. Data from Fitbit and other wearable technologies are allowing insurance companies to monitor customer health information to adjust premiums. At the other end of the spectrum, retailers use farm-level data to show their consumers where ingredients come from. By 2050 the average US farm is expected to produce over 4m data points every day, up from 190,000 in 2014.<sup>30</sup> Some believe that data could produce a new revenue stream for farmers, but it is largely given away for free at present.

Questions remain over who owns all this data and how will it be used in the future. Privacy is recognised as a human right by the UN Declaration of Human Rights. How this plays out is not specific to the food system, but unique issues do arise. Companies need to develop a transparent privacy policy to reassure employees and customers on how their data is being used and protected.

https://www.tractica.com/newsroom/press-releases/warehousing-and-logistics-robot-shipments-will-reach-620000-units-annually-by-2021/

<sup>30 &</sup>quot;Why IoT, big data & smart farming are the future of agriculture", Business Insider UK, December 20, 2016; as quoted referenced by IBM Watson, December 14, 2016.

## 18. Evolution of the last mile (retail)

The growth of online food retail is part of a series of changes across food distribution. In their efforts to make home delivery profitable, grocery retailers are aiming to develop seamless "omnichannel" fulfilment models (that is, models that integrate online shopping across various devices and channels with offline shopping). Some food retailers are adapting to e-commerce by limiting their online product or geographical offerings to maintain profit margins, while others are partnering with digital start-ups to outsource fulfilment of grocery shopping.

Amazon demonstrated that it can "jump" over the prevailing business model of occupying large physical store outlets. With its purchase of Whole Foods, Amazon's entry into the North American grocery space has traditional grocers scrambling to develop home delivery and online food shopping. The company promises nextday delivery and has targeted offerings, such as Prime Pantry, a service that allows consumers to bundle multiple small grocery items into boxes, avoiding the need to bulk buy or face prohibitive transport costs. Amazon Dash is a scanning device that allows consumers to set up a home inventory system to facilitate repeat purchases. In China, Alibaba now routinely sets Guinness World Records, such as selling the most litres of milk, peanuts and apples online in one day (among other consumer products).

Achieving efficiencies in long-distance shipping and in the last mile to the consumer's door or local store is being further enabled by digital innovation, including AI, which will help to optimise routes, cut costs and increase delivery of better-quality food.

## 19. Evolution of the last mile (restaurants)

The rise of online delivery platforms, which allow consumers to compare various food options and order with a single click, is leading to a surge in "virtual restaurants" (that is, those with no dine-in option). These have been facilitated by the success of apps such as 'Uber Eats' and 'Deliveroo', which provide logistics and delivery support to restaurants. Aggregator platforms, such as FoodPanda and Grubhub, route customer

orders to restaurants that then handle the delivery themselves. The global online food delivery market was estimated at US\$83bn in 2018, and some estimates suggest that it may grow to US\$140bn by 2023.<sup>31</sup>

The rise of virtual restaurants will have several implications for the food industry. For example, these outlets will prioritise new types of niche food that stand out from competitors and are more suitable for delivery. Traditional dine-in restaurants, meanwhile, will need to invest in more entertainment, activities and "experiences" to attract consumers.

## 20. Programmes and apps to redistribute surplus food

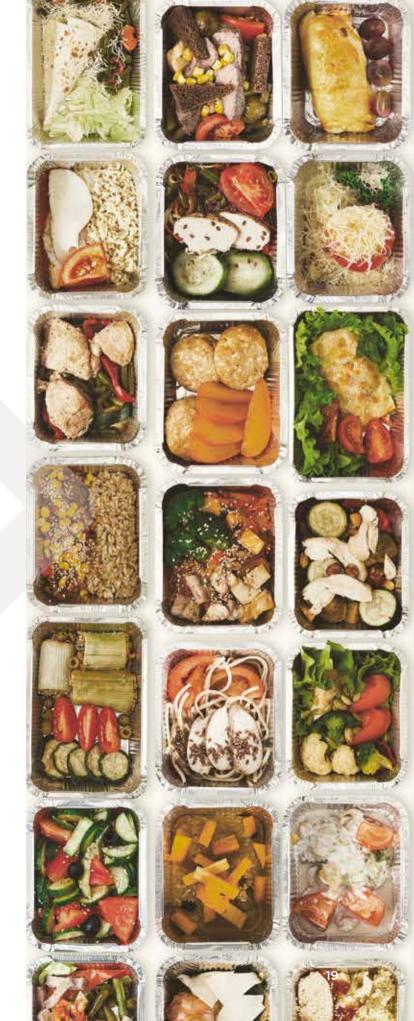
Nearly a third of the world's food is wasted or lost.<sup>32</sup> In industrialised countries, 40% of losses take place at the retail and consumer levels.<sup>33</sup> From an environmental and food security standpoint, consuming food already produced is preferable to cutting down more forests to grow more food. The UN Food and Agriculture Organisation (FAO) calculates that if food wastage were a country, its emissions would rank it as the third largest emitting country, after China and the US.<sup>34</sup>

As part of efforts to combat food waste, supply chain stakeholders are creating websites, apps and programmes to divert edible food towards consumers and those facing hunger. NoFoodWasted is a Netherlands-based app that alerts shoppers about food expiry dates. Tesco has gained recognition for taking a datadriven approach to reducing waste across its entire supply chain. It has also partnered with FoodCloud, a social enterprise that matches retailers with surplus food stocks with charities to deliver it to those in need. Such efforts could help to combat the environmental effects of food waste and improve local food security.

For supply chains, reducing food loss and waste is an opportunity not only to reduce costs, but also to build rapport with consumers who are increasingly concerned with this issue. It may also become a matter of regulatory obligation: France and Italy have passed legislation to reduce and divert food waste among their respective grocery sectors.

## **US\$140bn**

Forecast for global food delivery market size by 2023



 $<sup>^{31} \</sup>quad \text{https://www.statista.com/outlook/374/100/online-food-delivery/worldwide} \\$ 

<sup>32</sup> http://www.fao.org/food-loss-and-food-waste/en/

<sup>33</sup> http://www.fao.org/save-food/resources/keyfindings/en/

<sup>&</sup>lt;sup>34</sup> "Food wastage footprint & Climate Change", FAO.

**Chapter 03** 

## A closer look at the GCC

Although all trends deserve consideration, three trends presented in this report are particularly relevant to the GCC because they are directed at enhancing the resilience of food systems.

The GCC's natural landscape constrains traditional agricultural production, but technology emerging in 'Industry 4.0' can be deployed to scale-up production in key niches. Pursuing more sustainable food practices can deliver economic efficiencies and unleash innovation across the food system, thereby reducing certain drivers of food insecurity. Finally, food strategy should remain as a priority. By leveraging its role as a regional trade hub, the GCC can position itself as a leader in fostering trade in sustainably sourced food—with its associated economic benefits—and further help to reduce food supply risks at a time of increasing global trade uncertainty.

## 1. The emergence of controlled systems for facilitating local food production

Farmers in the GCC region face unique agronomic challenges. Two soil orders dominate the GCC landscape, according to Shabbir Shahid, a former senior fellow at the International Centre for Biosaline Agriculture: "One is 'aridisols' which contain gypsums, calciumcarbonate and salts. The rest, almost 75% in the UAE, comprises 'entisols', which are sand dunes and other sandy soil." There are variations among the GCC countries, he explains, with Saudi Arabia having more diversity in soil types and Qatar with a much lower percentage of arable land. The region's soil profile is compounded by other constraints, notably high temperatures, water scarcity and rising groundwater salinity, limiting the choice of crops that can be grown. Frequent irrigation is required—up to two or three times a day, Mr Shahid estimates—which also stresses groundwater sources. The emergence of controlled systems, enhanced as a result of technologies such as automation and the Internet of Things, is thus a key trend for the region, as countries across the GCC experiment with hydroponics and vertical farms.

Some GCC states have been experimenting with hydroponics for decades, but only in recent years have they moved towards developing commercial-scale farms. As discussed in the preceding chapter, there is growing global recognition of the productivity benefits of hydroponics (despite higher energy consumption) and its suitability for agricultural production in regions lacking the climatic conditions for traditional farming. In the region, hydroponics has been used for the cultivation of tomatoes, cucumber, pepper and strawberries, but has also been used to produce papayas, oranges and rice, albeit on a small scale.

Peninsula Farms in Bahrain uses hydroponics to produce leafy green vegetables, and use of hydroponics at Badia Farms in the UAE, the region's first commercial vertical farm, is expected to reduce water consumption by 90% in the production of lettuce.<sup>35</sup> Encouraging such production must also be complimented by having the right channels to market, either through traditional food retailers or through other, creative ways. The Dubai-government-owned Emirates

The GCC's natural landscape constrains traditional agricultural production, but technology emerging in 'Industry 4.0' can be deployed to scale-up production in key niches

Airlines has partnered with US-based Crop One to build the world's largest vertical farm, also using hydroponics. As a public-private partnership, it may serve as a model for more engagement with the private sector in this space. Taking full advantage of food production innovation can benefit from new collaborations across the GCC's food system.

Consumers may also appreciate learning about the provenance of their vegetables. "Going local" is big business in many countries. Technology might help promote this connection across the GCC. Apps such as Zomato, UberEats and Deliveroo in the GCC have revolutionised food delivery from restaurants (although online shopping for groceries is less prevalent), but such platforms could also be used to promote hydroponically grown local produce.

## 2. A shift in mindset towards the circular economy

Saudi Arabia and the UAE, the two GCC countries featured in the EIU's Food Sustainability Index, rank in the bottom quartile of the 34 countries covered in the index, with low scores for nutrition, and food loss and waste. This provides more impetus for the transition already underway among farmers, policymakers and other food industry experts in the region towards a circular economy.

Using circular economy thinking for the food industry in the GCC presents numerous opportunities, experts say. To improve soil quality, Mr Shahid recommends recycling "green waste" from urban landscaping to create compost and biochar, an opportunity that he believes is largely untapped in the region. "Biochar, when used in the soil, can hold a lot of water, generating savings in terms of water and fertilisers," explains Mr Shahid. Based on research conducted in the UAE, he estimates that 30-40% of water and 25-30% of fertiliser can be saved.

Governments in the region are taking steps to develop a regulatory framework to enable recycling of waste into compost. The Saudi, UAE and Omani governments are respectively aiming to recycle 85%, 75% and 60% of their countries' municipal solid waste over the next decade.<sup>36</sup>

Recognition of the need to reduce food waste is perhaps the most visible manifestation of shifting societal attitudes toward sustainable consumption. As elsewhere, the food waste issue is gaining traction among consumers, companies and governments in the GCC. A highly publicised campaign in Dubai, #ZeroFoodWaste, is designed to change behaviour among consumers and the food services sector.<sup>37</sup>

Evidence supports the need to change. Annual food waste is estimated at 427kg/person in Saudi Arabia and 197kg/person in the UAE, compared with 95-115kg/person in Europe and North America.<sup>38</sup>,<sup>39</sup> Awareness of food waste, particularly during the month of Ramadan, is growing, according to a YouGov survey conducted in the UAE, Saudi Arabia and Egypt.<sup>40</sup> "Hospitality and tourism are the biggest sources of food waste [in the region]," explains Tara Fischbach, research assistant at Mohammed Bin Rashid School of Government.

As with other agri-food priorities, new technologies can play a key role. Although Foodwatch, a digital platform operated by Dubai Municipality, is primarily dedicated to improving food safety and traceability, it could become a tool to promote better food use, thereby reducing waste.

Reducing food waste and loss spans the supply chain as well. Blockchain and the IoT are

being considered as ways to drive efficiency and transparency in transport and logistics. The promise of shrinking timelines for freight forwarding and more accurate monitoring of cargo conditions in real time is particularly beneficial to the food trade, as it can, for example, reduce spoilage and ensure better food quality. IBM has partnered with Dubai Customs to explore a blockchain solution for trade finance and logistics, specifically looking into transmitting shipment data to key stakeholders in real time.

The impetus for tackling food waste is both an economic issue—it can improve efficiency, reduce costs and lower carbon footprints—and a consumer-facing issue as more and more people embrace food waste reduction as important to them and their families.

## 3. Greater attention to national food security strategies

The GCC's limited ability to cultivate crops required to meet local food demand has meant that the region relies heavily on food imports from around the world. Approximately 60-90% of food consumed in the GCC is imported from abroad.<sup>41</sup> Food security has been a priority, with the UAE, Saudi Arabia and Oman improving their food security positions between 2012 and 2017, according to The EIU's Food Security Index.

National food security strategies have been a priority for many years, especially following the 2008 food price crisis. However, strategy is a live process that should be regularly updated to reflect evolving risks and opportunities. Certain food trends might help to inform GCC strategy in this regard, notably the evolving trade situation (chapter 1, trend #3) and the global adoption of sustainability targets (chapter 1, trend #4); both are briefly addressed below.

Conducting a fuller assessment of the economic, environmental and technological risks facing the region's food system might be well-advised. Although the region is import-dependent, lacks agricultural capacity and has limited access to freshwater, its strengths include being a regional trade hub with high volumes flowing from Asia to Europe and Africa, and vice versa. Its ports are world class and embrace advanced technologies.

Given recent global trade developments (rising tariffs, the proliferation of regional trade agreements and potential realignment of trade flows), the GCC is presented with an opportunity to demonstrate its leadership in promoting open and efficient food trade. Moreover, the emergence of new technologies emerge to improve supply chain integrity and productivity will be particularly relevant for reasserting the region's food trade leadership in the region.

Evidence supports the need to change. Annual food waste is estimated at 427kg/person in Saudi Arabia and 197kg/person in the UAE, compared with 95-115kg/person in Europe and North America

<sup>35</sup> https://www.thenational.ae/uae/environment/gcc-s-first-commercial-vertical-farm-launches-in-dubai-1.710068

<sup>36</sup> https://www.worldfutureenergysummit.com/wfes-insights/gcc-government-mandates-see-waste-management-efforts-stepping-up

https://gulfnews.com/news/uae/society/zerofoodwaste-dubai-wages-waragainst-food-waste-on-world-food-day-1.2106098

<sup>38</sup> http://foodsustainability.eiu.com/gulf-region/

<sup>39</sup> http://www.fao.org/save-food/resources/keyfindings/en/

<sup>40</sup> https://www.arabianbusiness.com/culture-society/398300-middle-east-becoming-more-aware-of-food-waste-impact-survey-shows

https://www.unescap.org/sites/default/files/Food%20and%20Agricultural%20 Trade%20in%20the%20GCC\_Jeevika\_Sept2014.pdf





## Conclusion

How countries and supply chains respond to the vast array of food issues, including the twenty agri-food trends identified in this report, could very well be a leading indicator of how the planet's overall prospects will be defined for the future. Successful approaches to produce, supply and consume food touch on every issue: health, environment, rural and urban populations, human and animal rights, social stability and governance, and jobs, livelihoods and prosperity. Managing "food" could become the global catalyst for positive change or, improperly handled, it could accelerate the demise of eco-systems, people's health and societal stability.

For the GCC, the three trends discussed in the preceding chapter will help move the region's food industry into the next gear. However, one notable enabling factor must be in place if the region's food industry is to truly advance: the region must work to build sustainability into all aspects of its food system. There are many dimensions to this, but two ideas are suggested.

The first is greater adoption of food sustainability targets, not just at the national level but by corporations as well. Indeed, the entire food system needs to assess its contribution to sustainability to help ensure resilience and greater food security. Only when the industry's overall carbon, water and biodiversity impacts or footprints are being measured and disclosed will there be real movement towards genuine sustainability.

The second is incorporating principles for sustainable capital. Considerable work is being conducted among international organisations to consider how to better assess financial risk and improve financial reporting with climate change impacts in mind, among other issues. The Dubai Financial Market is among nearly 60 stock exchanges worldwide, for instance, that is part of the Sustainable Stock Exchanges Initiative.<sup>42</sup>

Improving such transparency is not only becoming recognised as good financial practice, it is also part of a larger shift to place sustainability at the heart of corporate strategy-making. As noted in this report, many global food companies are embracing this approach, and GCC companies would be well-advised to consider sustainability as a strategic issue as well.

In this way, the GCC could define its unique pathway to confront and reconcile these challenges—and inspire the world through its approach to doing so.

<sup>42</sup> http://www.sseinitiative.org/sse-partner-exchanges/list-of-partner-exchanges/



http://dubaiindustrialcity.ae

Phone: +971 4 3910062

Fax: +971 4 4290200

@DubaiIndCity